proposed authorization law would do the following:

- Permit the AEC to waive charges for the use of heavy water in enriched as well as natural uranium reactors, thus permitting the proposed Florida and North Carolina heavy water power reactor projects to benefit from this waiver.

- Permit the proposed plant of the East Central Nuclear Power Group and the Florida West Coast Nuclear Power Group to receive federal assistance under the third round of the AEC's power demonstration reactor program. This project, unless it receives specific statutory authorization for assistance, will be excluded from the "third round" of the demonstration program because its target date for completion is beyond the deadline of June 30, 1962, set initially by the AEC.

- Permit Phase I of the Pennsylvania Power & Light Co.-Westinghouse Electric Corp. proposal, which provides for research and development prior to possible construction of an aqueous homogeneous power reactor, to receive federal assistance under the AEC power demonstration reactor program. This project requires specific statutory authorization for assistance because it also does not meet the "third round" criterion of a June 30, 1962 completion target date.

- Make available an additional $1,250,000 for "research and development in Commission laboratories to advance the technology of the fast breeder reactor concept"—research which it is acknowledged by the Committee will be of direct benefit to the fast breeder power reactor project of the Power Reactor Development Corp. at Lagoona Beach, Mich.

Relatedly, the President early this month signed a separate bill authorizing an additional $2.25 million for Project Sherwood controlled thermonuclear research facilities, mainly at Princeton University, and authorizing an additional $9.4 million for particle accelerator projects at Cambridge, Mass. and Princeton, N. J. These projects were originally authorized in previous years.

Hearings on AEC's fiscal year 1959 appropriations began on July 1 in closed sessions before the House Appropriations Committee.

A Package for Euratom

Last February (see "U.S.-Euratom Power Program," *Memo* for March) the U.S. government and the then newly formed European Atomic Energy Community (usually called "Euratom") announced that they planned cooperatively to work toward "the possibility of initiating at an early date a joint program of the order of one million kilowatts for the development of full-scale prototype reactors."

Last month — on June 23 — the executive branch of the U.S. government sent to the Congress a voluminous but neatly wrapped package of proposed agreements and recommended implementing actions designed to launch the joint U.S.-Euratom one million kilowatt atomic program this year. The parts of the package requiring Euratom approval had already been signed by the Euratom Commission on May 29. The parts requiring U.S. approval had been signed by the U.S. Secretary of State and the chairman of the U.S. Atomic Energy Commission on June 12, subject to Congressional ratification.

At June's end, Congressional representatives were busy rummaging around in the sometimes dark, often complicated recesses of the executive branch's Euratom package, trying to find just what there was in it to like and to dislike. Most of the time this rummaging was accompanied by grumblings to the effect that it is far too late in the present session to hand such a complicated package to the Congress with any reasonable expectation of action before adjournment.

Contents: In the package sent to the Congress last month were a proposed "International Agree-

ment" between the U.S. and Euratom establishing the broad principle that "the parties will cooperate in programs for the advancement of the peaceful applications of atomic energy," a proposed 25-year "Agreement for Cooperation" spelling out in fairly specific detail the respective roles of the U.S. and Euratom in the joint one million kilowatt program, and a draft implementation bill which would authorize the use of the funds and materials needed for the U.S. to fulfill its part of the proposed agreement. Also included was a "Memorandum of Understanding" plus a collection of other working papers, correspondence and studies which formed the basis of the U.S.-Euratom negotiations.

The specific actions the Congress is being asked to take are, first, to approve the generalized International Agreement; second, to pass the draft implementation bill, and, third, to grant a waiver permitting the Agreement for Cooperation to take effect without the 30-day waiting period during which such documents must usually lie before the Joint Congressional Committee on Atomic Energy before they can take effect. All of these actions involve majority votes in both houses of Congress.

The other documents sent to the Congress last month were provided as background information. They will, however, constitute an important part of the legislative history of any U.S. agreement with Euratom, and will, therefore, unless superseded or revised, have an important effect on the manner in which U.S. cooperation with Euratom is carried on.

Main Elements: If the Congress approves the package delivered to it last month, here, in effect, are the seven main elements of the program it will be placing in operation:

1. There would be constructed in the Euratom countries by 1963 one million kilowatts of nuclear power capacity using, in the language of the Agreement for Cooperation, "nuclear reactors of proven types on which research and development have been carried to an advanced stage in the United States."

2. There would be undertaken cooperatively by the U.S. and Euratom a ten-year research and development program aimed primarily at improving the performance of the types of reactors to be constructed under the joint program and at the lowering of fuel cycle costs.

3. The U.S. would sell to Euratom up to 30,000 kilograms of U-235 for use in the reactors constructed under the joint program.

4. The U.S. would be prepared to perform chemical processing services as requested by Euratom with respect to fuel provided by the U.S.

5. The U.S. would be prepared to purchase for peaceful use at prices in effect at the time of purchase all plutonium and other special nuclear materials produced in reactors built under the joint program and not retained for peaceful use by Euratom or purchased by the International Atomic Energy Agency.

6. The U.S. would offer fuel cost and performance guarantees which, in the language of an annex to the Agreement for Cooperation, would be "designed to limit certain financial risks associated with the fuel cycle."

7. Euratom would undertake through a safeguards and inspection system to make sure that none of the material or equipment provided by the U.S. would be used for other than a purely peaceful purpose.

The Million Kilowatts: Each of the seven main elements of the Euratom package as listed above is broken down into a host of details which answer some, but not all, of the questions that delivery of the package has raised in the Congress and in the American atomic industry. Some of the more important of these details and their accompanying rationales are as follows:

Desirability of the program: In a message transmitting the proposed International Agreement to the Congress, President Eisenhower described the program as "a further step toward a united Europe," a goal which he said was "of vital importance to the U.S." He also said that "a central purpose of the proposed joint program is for Euratom and the U.S. government to create an institutional and economic environment which will encourage the European utilities to embark quickly upon a large-scale nuclear power program. As this program goes forward, it will make possible significant progress in the development of atomic power elsewhere in the world."

Economic objective: The draft Agreement for Cooperation says that it is an objective of the program to build and operate the one million kilowatts of capacity "under conditions which would approach the competitive range of conventional costs in Europe." According to a working paper accompanying last month's Euratom package, the kilowatt hour cost of a typical new coal-fired plant was listed at 10.9 mills and of a typical new oil-fired plant at 9.8 mills.

Capital cost: The Agreement for Cooperation says that "the total capital cost, exclusive of fuel inventory, of the nuclear power plants . . . to be constructed under the program is estimated not to exceed the equivalent of $350 million," which is $350 per installed kilowatt.

U.S. loan: The Agreement for Cooperation says that "up to $135 million" of the total $350 million required to finance the one million kilowatt program will be provided on a loan basis by the U.S. government. In a letter accompanying the Euratom package to the Congress last month, then AEC Chairman Lewis L. Strauss told Joint Committee Chairman Carl T. Durham that the $135 million of U.S. capital "would be provided by the Export-Import Bank to Euratom in the form of a long-term line of credit at 4½% interest." He did not say how long the term of the loan would be, but a working paper dealing with costs which was included in last month's Euratom package assumed a 15-year, 4% governmental loan in three cases and a 30-year, 4.75% loan in one case. In this connection, it is probably worth noting that the proposed U.S.-Euratom Agreement for Cooperation is for a term of 25 years.

European financing: The Agreement for Cooperation says that about $215 million of the $350 million required is expected to be provided "by the participating utilities and other European sources of capital." In his letter to Joint Committee Chairman Durham last month, AEC Chairman Strauss said that, of the $215 million to be provided from European sources, "preliminary contacts by Euratom with European utilities have indicated that the utilities will have no difficulty in arranging financing equivalent to that needed for one million kilowatts of conventional power—about $150 million." Added Strauss: "This, plus the U.S. loan of $135 million, leaves approximately $65 million to be found of the overall capital cost of the program. The president of the Euratom Commission has already approached the European Investment Bank and has asked that the Bank take the lead in arranging for financing this remaining $65 million."

Re-loan of U.S. funds: The Agreement for Cooperation says that funds lent by the U. S. Export-Import Bank to Euratom will "be relent by the Community for the construction of facilities under this program." The repayment burden, therefore, with its economic implications, falls on the owner of the facility, who will borrow from, and repay to, the Euratom Community. The Euratom Community will be liable for repayment to the U. S. Export-Import Bank.

Eligible participants: The proposed Agreement for Cooperation says that "reactor projects may be proposed, constructed and operated by private or governmental organizations in the [Euratom] Community engaged in the power industry or in the nuclear energy field." The Agreement goes on to say that "reactors now being planned or constructed . . . will be eligible for, and will receive, early consideration." Although the draft Agreement says nothing about ownership, it would seem that the word was omitted inadvertently, inasmuch as AEC Chairman Strauss in his letter to Rep. Durham last month said clearly that "the nuclear power plants under the program will be built, owned and operated by utilities in the member states."

Selection of projects: The Agreement for Cooperation says that projects to be included in the U. S.-Euratom program "will be selected in accordance with technical standards, criteria (including those relating to radiation protection and reactor safety), and procedures developed by the U. S. Atomic Energy Commission and the Euratom Commission." The Agreement goes on to say that "the technical and economic features will be considered and approved jointly by the U. S. Commission and the Euratom Commission; other features . . . will be considered and approved by the Euratom Commission."

Number and size of projects: A working paper included in last month's Euratom package states that, "taking into account the nuclear

power projects already in existence in the various European countries, [current objectives] seem to suggest that a program of six to eight additional reactors, properly distributed among several Euratom nations, would be most effective." The paper also states: "These units should . . . mostly fall within the range of 100 to 200 electrical megawatts. Thus, the total capacity of the program would be in the range of 600-1,000 emw, but it is expected that the total will fall near the middle of this range."

The meaning of "proven types": The U.S.-Euratom program, by virtue of the language of the Agreement for Cooperation, is limited to "nuclear reactors of proven types on which research and development have been carried to an advanced stage in the U.S." By letter of May 8 to the U.S. AEC's Deputy General Manager Richard W. Cook, who was one of the U.S.'s chief negotiators of the Euratom Agreement, the chief negotiator on the Euratom side, Max Kohnstamm, explained the meaning of the phrase "proven types" in these words: "In terms of the current state of technology, this would mean that initially the program would be oriented primarily towards large-scale nuclear power plants employing reactors of the pressurized and boiling water types." Kohnstamm went on to say: "I emphasize the word 'primarily' inasmuch as I believe that it would be unwise to forego the consideration of other types of reactors (e.g., the organic moderated concept) that may meet the criterion of 'proven types' development in the U.S. and thus meet the objectives of the joint program. Any such proposals, in our judgment, should receive due consideration by the Euratom Commission and the government of the U.S. in the course of the implementation of the program." Cook on June 12 wrote back to Kohnstamm to say that "we agree that the program must be sufficiently flexible to provide for the consideration of other types of reactors in addition to the boiling water and pressurized water varieties."

Timing of the projects: In a working paper included in last month's Euratom package and agreed to by the negotiators of both sides, a target schedule was established "under which projects are selected no later than 1959 and construction is completed no later than 1963."

Information rights: According to the Agreement for Cooperation, all non-patentable information developed in connection with the one million kilowatt program would be freely available to both the U.S. and Euratom and "may be used, disseminated, or published by each party for any and all purposes as it sees fit without further obligation or payment." Although the Agreement is silent on the point, the U.S. AEC has informed the Forum *Memo* in response to a question that it is envisioned that patentable information will not be available to the governments concerned except as it may be produced under a Euratom or U.S. government contract. Patents used in the program which are owned by the U.S. government, or concerning which the U.S. government has the right to grant licenses, would be available for license or sublicense to Euratom member states or industries on a reciprocal basis.

R&D Program: So far as the proposed joint research and development program is concerned, the draft Agreement for Cooperation contains the following interesting details:

- The program "will be aimed primarily at the improvement of the performance of [reactors of the types included in the overall power plant construction program], and at lowering fuel cycle costs. It will also deal with plutonium recycling and other problems relevant to these reactors."
- The program will "be conducted both in the United States and in Europe."
- The program "will be established for a ten-year period."
- "During the first five years the financial contribution of the government of the U.S. and the Community will amount to $50 million each. . . . Funds for the second five-year period may be in the same order of magnitude."
- All non-patentable information developed under the joint R&D program "will be delivered currently to [both the U.S. government and Euratom] as developed, and may be used, disseminated, or published by each party for any and all purposes as it sees fit without further obligation or payment."
- Both the U.S. government and Euratom "shall have access to the records of the participating contractors pertaining to their participation in research and development projects" financed by the joint R&D program.

• So far as patentable inventions are concerned, the U.S. would own the patent rights within the U.S. and Euratom would own the rights within the six Euratom countries. Each party would grant to the other a non-exclusive, royalty-free license to the patents owned by it. In addition, the Agreement for Cooperation specifies that "neither party shall discriminate in the granting of any license or sublicense for the reason that the proposed licensee or sublicensee is a national of the U.S. or any member state of the Community."

Sale of U.S. Fuel: In last month's Euratom package there were the following important details concerning the provision of U.S. fuel for the joint U.S.-Euratom program:

Quantity of uranium: In the proposed Agreement for Cooperation with Euratom the U.S. government agrees to "sell to the [Euratom] Community uranium enriched in the isotope U-235 for use in projects designated by the parties pursuant to the joint program up to a net amount of 30,000 kilograms of contained U-235 in uranium." The Agreement specifies that "this net amount shall be the gross quantity of contained U-235 in uranium sold to the Community less the quantity of contained U-235 in recoverable uranium which has been resold or otherwise returned to the U.S. government or transferred to any other nation or international organization with the approval of the U.S. government."

Calculation of quantity: In a working paper, the U.S.-Euratom negotiators explained their arrival at the 30,000 kg figure in this way: "Consider a pressurized or boiling water reactor having a power level of approximately 150 electrical megawatts and an irradiation level between 7,000 and 10,000 megawatt days per metric ton. The fuel to be supplied for the inventory, including the reactor loading and material being fabricated, cooled and processed, will contain about 1,300 kilograms of U-235. The burnup of U-235 in such a reactor operated at 80% load factor will be about 150 kilograms per year. For the entire one million kilowatt program, the total inventory will contain about 9,000 kilograms of U-235 and the burnup will be about 1,000 kilograms per year. For 20 years of operation, a total of 29,000 kilograms of contained U-235 will need to be supplied for inventory and burnup. If 1,000 kilograms are added for research and test reactors associated with the program, this figure becomes 30,000 kilograms."

Additional fuel: The draft Cooperation Agreement with Euratom specifies that "the U.S. Commission will . . . from time to time sell to the Community such quantities of special nuclear material, in addition to the quantities of enriched uranium set forth above, as may be agreed."

Plutonium: In addition to the 30,000 kilograms of U-235 specified in the Agreement for Cooperation, the draft implementation bill now before the Congress would authorize, if passed, the sale of one kilogram of plutonium to the Euratom Community.

Title to fuel: The proposed Agreement for Cooperation states that "it is agreed that the Community may distribute special nuclear material to authorized users in the Community," but adds that the Community "will retain . . . title to any special nuclear material which is purchased from the U.S. Commission."

Enrichment limitation: The Agreement for Cooperation states that uranium provided by the U.S. "for use in reactors designed for the production of electric power may be enriched up to 20% by weight in the isotope U-235." The Agreement goes on to say, however, that the U.S. Commission may, "upon request and in its discretion, make a portion of the [uranium provided] available as material enriched up to 90% for use in materials testing reactors and research reactors, each capable of operating with a fuel load not to exceed eight kilograms of contained U-235 in uranium, and as highly enriched material for use for research purposes."

Method of payment: As to how Euratom would pay for the 30,000 kg of U-235 it would receive under the proposed program, a "funding summary" included in last month's Euratom package described this as follows: "The initial operating inventory, which amounts to approximately 9,000 kilograms of contained U-235, will be sold to the Community on a deferred payment basis at the domestic prices in effect in the U.S. at the time of transfer. Payment by the Community on the principal may be deferred for a period not to extend beyond December 31, 1973, with interest to be paid on this debt

at 4% per annum. After the deferral period, Euratom will start paying, in equal annual installments, the debt incurred for fuel plus interest at 4% per annum on the unpaid balance. These payments will have to be completed by December 31, 1983." The summary goes on to say that the remaining 21,000 kg of U-235 needed for power reactor reloadings and test reactor use "would be paid for on a current basis." The U.S. AEC estimates that the U.S.'s net revenue (less credits for uranium returned after irradiation) from this source during the first 10 years of the program will be in excess of $90 million.

Chemical Processing: As part of the proposed U.S.-Euratom joint program the U.S. would be prepared to reprocess fuels provided by the U.S. to users in the Euratom countries. Some of the more important details concerning this proposed activity are as follows:

Charges: The Agreement for Cooperation says that "such reprocessing will be performed at established U.S. domestic prices in effect upon delivery of such material." (These are currently based on a minimum of $15,300 per ton for slightly enriched uranium.)

Duration: A working paper included in last month's Euratom package says that the U.S. will be prepared to perform reprocessing services for the one million kilowatt program "until such time as a suitable processing plant is constructed in Europe." As to when this will be, the paper says that "there may be an economic advantage in waiting until the power reactor capacity has reached several million kilowatts before building such a plant."

U.S. technical aid: The same working paper also says that the U.S. AEC "will be prepared to provide technical advice and assistance, as desired, in the design and construction of the Eurochemic pilot plant [to be built under OEEC auspices at Mol, Belgium,] and in the design and construction of any future large-scale chemical processing plant that the European Atomic Energy Community decides to construct."

Fuel Buy-Back: Among the key provisions in the Euratom package sent to Congress last month are those having to do with the disposition of the special nuclear materials, including U-235 and plutonium, that are recoverable from irradiated fuels obtained initially from the U.S. The more important details concerning this subject are as follows:

Disposition: The Agreement for Cooperation provides that Euratom may keep, subject to the proviso that they be used only for peaceful purposes, any of the materials, including U-235 and plutonium, extracted from fuel initially purchased from the U.S. This applies whether or not the fuel is processed in the U.S. or Europe. With respect to such materials which are in excess of Euratom's needs, the Agreement says that "the International Atomic Energy Agency is granted the right of first option to purchase [them] at the announced fuel value price in effect in the U.S. at the time of purchase." The Agreement then goes on to say that, "in the event this option is not exercised by the International Atomic Energy Agency, the U.S. government is prepared to purchase such material at the U.S. announced fuel value price in effect at the time of purchase."

Plutonium quantity limitation: The draft implementation bill now before the Congress would authorize the U.S. AEC "to acquire from the Community . . . up to 4,100 kilograms of plutonium for use only for peaceful purposes."

Plutonium time limitation: The draft implementation bill provides that no contract to purchase plutonium from reactors included in the joint program "shall be for a period greater than 10 years of operation of such reactors or December 31, 1973, whichever is earlier."

Plutonium buy-back price: The funding summary included in last month's Euratom package says that "the expenditures required to cover repurchase of all plutonium estimated to be recovered from reprocessed spent fuel from [the joint program] during the 10 year period" would amount to $50 million. This, considering the 4,100 kilograms authorized to be purchased, gives a per-gram price for the plutonium of $12.

U-235 provisos: According to the funding study, the only limitations on U.S. purchase of U-235 in irradiated Euratom fuels is that the quantity should not exceed the total quantity provided initially by the U.S. less burnup, that no purchase commitments should be made be-

CONFERENCE AND COURSE SCHEDULE

The following forthcoming conferences and courses are concerned wholly or in substantial part with subject matter of interest to the atomic industry:

International Congress on Nuclear Physics, cosponsored by International Union of Physics and UNESCO, Paris, France, July 7-12. Contact: Comité d'Organisation du Congrès International de Physique Nucléaire, Institut du Radium, 11, rue Pierre Curie, Paris 5, France.

Nuclear Engineering Survey, University of California, Berkeley, Cal., week of July 7. A program for executives on nontechnical aspects of nuclear science and its application to industry. Contact: Engineering and Sciences Extension, Room 100, Building T-11, University of California, Berkeley 4, Cal.

International Congress of Radiation Research, sponsored by the National Academy of Sciences-National Research Council and the Radiation Research Society, University of Vermont, Burlington, Vermont, August 10-16. Contact: Harvey M. Patt, ICRR, Argonne National Laboratory, P.O. Box 299, Lemont, Ill.

Second International Conference on the Peaceful Uses of Atomic Energy, United Nations, Geneva, Switzerland, September 1-13. Contact: Office of International Conference, U.S. Atomic Energy Commission, Washington 25, D. C.

International Instrument-Automation Conference, Instrument Society of America, Convention Hall, Philadelphia, Pa., September 15-19. Two sessions on nuclear instruments. Contact: Fred J. Tabery, 3443 S. Hill St., Los Angeles, Cal.

International Symposium on Nuclear Electronics, UNESCO House, Paris, France, September 16-20. Contact: Colloque International Electronique Nucléaire, 10 Avenue Pierre-Larousse, Malakoff (Seine), France.

Second Conference on Analytical Chemistry in Nuclear Technology, Oak Ridge National Laboratory, Civic Auditorium, Gatlinburg, Tenn., September 29-October 1. Contact: C. D. Susano, Oak Ridge National Laboratory, P. O. Box Y, Oak Ridge, Tenn.

Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers Fall Meeting, Carter Hotel, Cleveland, Ohio, October 27-30. Nuclear Metallurgy Committee to hold symposium on fabrication of fuel elements. Contact: Metallurgical Society of AIME, 29 West 39th St., New York 18, N. Y.

Annual Conference, Atomic Industrial Forum, Shoreham Hotel, Washington, D. C., November 10-12. Contact: Conference Manager, AIF, 3 East 54th St., New York 22, N. Y.

Four Courses in Radiological Health, New York University-Bellevue Medical Center Post-Graduate Medical School, New York, N.Y., beginning in November: Radiochemical Analysis, November 10-21; Introduction to Radiological Health (full time), January 5-16, 1959; Radiological Health Laboratory (full time), January 19-30; and Radiation Hygiene Measurements, May 4-29. Contact: The Associate Dean, NYU Post-Graduate Medical School, 550 First Ave., New York 16, N. Y.

yond the lifetime of the Agreement for Cooperation, which is 25 years, and that the price should not exceed the domestic published price schedule.

Fuel Guarantee Rationale: Of all the provisions of the Euratom package sent to Congress last month, probably the most controversial and least understood are those having to do with an intricate system of fuel cycle guarantees designed to assure that reactor fuel costs will be kept within low enough limits to retain the interest and participation of European utilities in the U.S.-Euratom power program. In various of the working papers provided to the Congress last month, the method by which they were arrived at emerges as follows:

1. If the power plants in the one million kilowatt program range in cost from $250 to $350 per installed kilowatt, as estimated, then these capital costs under the financing scheme envisioned (part low interest government loan, part normal financing, giving an overall interest rate of about 6%) will amount to about 5.5 to 7.7 mills per kilowatt hour. This compares with capital costs for an equivalent coal-burning facility of about 3.1 mills per kwh.

2. Coal in Europe now costs on the average of 6.8 mills per kwh, and operation and maintenance for coal-fired plants together cost about 1.0 mills per kwh, giving a total average cost of power from coal in the Euratom countries of about 10.9 mills per kwh.

3. If, in the light of this cost of power from coal, European utilities are to be interested in experimenting with nuclear power at this point in time, then the fuel costs of nuclear power must be held to a sufficiently low level to counterbalance, in part at least, the comparatively high capital costs involved. In this connection, it is felt by the U.S.-Euratom negotiators that the interest of European utilities can be retained if fuel costs for the nuclear plants in the million kilowatt program could be held to 4.2 mills per kwh, giving overall nuclear power costs of about 11.7

to 13.9 mills, including an allowance of 2.0 mills per kwh for operation and maintenance. (The theory here is that nuclear power can be allowed to cost a little more at first because, during the life of the nuclear power plants, nuclear fuel costs will probably substantially diminish while conventional fuel costs will rise, thus canceling out uranium's initial disadvantage.)

4. It is felt by the U.S.-Euratom negotiators that this fuel cycle cost of 4.2 mills per kwh can be achieved if the following breakdown of costs can be achieved:

Fuel inventory	0.6 mills
U-235 burnup	2.3 mills
Fabrication	1.5 mills
Chemical processing	0.3 mills
Conversion of UNH to UF_6	0.1 mills
Transport and insurance	0.3 mills
TOTAL	5.1 mills
Plutonium credit	0.9 mills
NET TOTAL	4.2 mills

In this breakdown, the plutonium credit was figured at $12 per gram less $1.50 per gram to cover conversion of plutonium nitrate to plutonium metal, including losses.

5. It is felt in turn by the negotiators, as explained in their working papers, that the above breakdown of fuel cycle costs is achievable if uranium dioxide fuel elements between 0.25 and 0.50 inches in diameter and enriched up to 3% in U-235 cost no more than $100 per kilogram of contained uranium if clad in stainless steel and no more than $140 per kilogram of contained uranium if clad in zirconium, and if the buyer is assured an irradiation level of 10,000 megawatt days per ton.

Nature of the Guarantee: In essence, under the guarantee provisions of the Euratom package delivered to the Congress last month, the U.S. government undertakes to assure the European buyer of maximum fuel cycle costs equivalent to those described above (which are called "standard fuel cycle costs" in the Euratom papers), with appropriate adjustments if different enrichments, cladding or dimensions are used.

Among the more important details having to do with the guarantee are the following:

Who makes it: The guarantee can be made either by the fabricator or by the government, or by the two in combination. According to an Annex to the proposed Agreement for Cooperation, the government guarantee applies "only to the extent that equivalent or better guarantees are not available commercially."

How it works: According to an attachment to the Memorandum of Understanding in last month's Euratom package, the government guarantee works in this way: If a manufacturer guarantees a fabrication charge equal to or less than the standard maximum, but fails to guarantee fuel life, then the government would guarantee the life of the fuel to the extent required to bring the user's total fuel cycle bill within the "standard cost" limits. If, on the other hand, a manufacturer guarantees fuel life equal to or longer than the standard minimum of 10,000 megawatt days per ton, but fails to guarantee maximum charges, then the government would guarantee charges designed to bring the user's total fuel cycle bill within the "standard cost" limits. If the manufacturer guarantees neither fuel life nor charges, then the government would do both.

How it pays off: According to the Memorandum of Understanding, if fuel elements do not meet their guaranteed irradiation level, then the U.S. Commission would adjust the charges for fuel fabrication, and for the chemical processing and transportation services it performs, to a level that would bring the user's total fuel cycle bill within "standard cost" limits.

Rights of the government: Once a U.S. fuel element fabricator agrees to let the government guarantee his product, then, in the language of the proposed Agreement for Cooperation, both the U.S. government and the Euratom Commission "shall have access to the records [of the fabricator] pertaining to the performance of fuel elements that are the subject of the U.S. guarantee."

Government-fabricator relationship: The Memorandum of Understanding specifies that the guarantees offered by the U.S. government "will, in general, be extended to the utility through the fabricator of the fuel," thus (except for the very large loophole provided by the words "in general") keeping the government out of the contractual relationship between the U.S. supplier and his European customer. The working paper goes on to say, however, that, "in the event that it is determined by the U.S. Commission that the

fabricator is not meeting adequate performance standards, or, if it is mutually determined that a more advantageous source is available, other contractual arrangements will be made for supplying fuel elements under the guarantee."

Processing & transportation: Whether or not a U.S. fabricator meets the proposed guarantee commercially, it is expected that the U.S. government will have a direct contractual relationship with European users of U.S. fuel elements in two respcts—chemical processing and the transportation of irradiated fuel elements. This is expected to be the case at least until chemical processing facilities are available in Europe or on a commercial basis in the U.S. In this connection, the U.S. AEC expects that, if fuel elements covered by purely commercial guarantees fail to meet their guaranteed performance levels, the processing and transportation costs—which may be outside the terms of the commercial guarantee—are likely to be higher than antcipiated. "Under such conditions," the Memorandum of Understanding says, "the U.S. Commission will, for the purpose of prorating the chemical processing and/or transportation costs, offer to guarantee an average irradiation level which, in combination with the guarantees offered by the manufacturer, would result in" an acceptable total cost to the user. (If this offer is accepted by a U.S. fuel producer hitherto unencumbered by governmental intrusion into his affairs, then presumably he will thereby expose himself to the "access to the records" provision of the Agreement for Cooperation.)

Government patent rights: The papers in last month's Euratom package are silent on the question of whether or not the U.S. government will have any rights to patentable information developed on a project subject to a governmental guarantee and assisted in no other way by the government. It is understood that it is the intention of the U.S. AEC to avoid acquiring patent rights solely by virtue of the guarantee. Patent rights will, of course, accrue to the government in the case of the R&D contracts expected to be let in the fuel cycle field under the Euratom program.

Eligibility: A working paper in last month's Euratom package states that, in order for fuel elements to qualify for a U.S. government guarantee, they "must be fabricated by a U.S. manufacturer or by a manufacturer in Euratom countries under agreement with a U.S. firm or firms." The paper goes on to say that "the technical and economic criteria under which proposals will be evaluated for acceptance will include minimum standards for fabrication charge and integrity guarantee of fuel elements," and adds: "These criteria will also provide, as may be agreed, that subsequent reactor cores can be furnished by other than the initial fabricators."

Duration of guarantees: An Annex to the proposed Agreement for Cooperation states that "the guarantees provided by the U.S. Commission will be applicable to all loadings made in reactors under the joint program during ten years of operation or prior to December 31, 1973, whichever is earlier."

Cost of the guarantees: The draft implementation bill, if passed, would authorize the U.S. Atomic Energy Commission to spend up to $90 million between now and 1973 to back up its fuel element guarantees. This is considered to be the outside liability of the U.S. government under the proposed system of guarantees. Actual net costs are expected by the U.S.-Euratom negotiators to run between zero and $20 million over the period to 1973.

Rebate to the AEC: According to the Memorandum of Understanding developed by the U.S.-Euratom negotiators, it is expected that, when the average irradiation level of a core exceeds that guaranteed by the U.S. Commission, one-half of the resultant savings in fabrication costs will be credited to the Commission up to the cost of payments made by the AEC for fabrication charges for the core concerned.

Controversial aspects: Both the Congress and the U.S. industry are inclined to take more time than the executive branch has allowed to study the guarantee system proposed. Many Congressmen want to look at it closely to see if it in any way constitutes a "giveaway." Many industrial people want to look at it closely to see if it in any way constitutes a device which will serve "to put the government deeper into the atomic energy business."

Safeguards System: After the guarantee system, the next most likely part of last month's Euratom package to raise questions in the minds of Congressmen is the part which has to do with

safeguards and inspection. Actually, the safeguards and inspection portions of the Agreement for Cooperation have already been the subject of disagreement between the U.S.-Euratom negotiators and between various elements of the executive branch of the U.S. government, a disagreement which is generally understood to have delayed submission of the overall package to the Congress by several weeks. These differences have now been resolved, however, and are no longer an obstacle unless they are raised again in the Congress.

The essential difference between the safeguards system proposed in the Euratom Agreement and all other Agreements for Cooperation that the U.S. has entered into—and this is the difference that has caused the disagreement—is that, under the Euratom Agreement, the Euratom organization and not the U.S. government will operate the inspection system. The respective roles and rights of the two organizations are spelled out as follows in the draft Agreement for Cooperation with Euratom:

- "The [Euratom] Community undertakes the responsibility for establishing and implementing a safeguards and control system designed to give maximum assurance that any material equipment or devices made available pursuant to this agreement and any source or special nuclear material derived from the use of such material, equipment and devices, shall be utilized solely for peaceful purposes."
- "As has been requested by the Community, the government of the United States of America will provide assistance in establishing the Community's safeguards and control system, and will provide continuing assistance in the operation of the system."
- "The parties agree that there will be frequent consultations and visits between the parties to give assurance to both parties that the Community's safeguards and control system effectively meets [agreed upon principles] and that the standards of the materials accountability systems of the governments of the United States and the Community are kept reasonably comparable."
- "It is understood by the parties that a continuation of the cooperative program between the government of the U.S. and the Community will be contingent upon the Community's establishing and maintaining a mutually satisfactory and effective safeguards and control system."

The problem of the rights of the International Atomic Energy Agency was handled in pretty much the same manner in the following words:

"In establishing and implementing its safeguards and control system, the Community is prepared to consult with and exchange experiences with the International Atomic Energy Agency with the objective of establishing a system reasonably compatible with that of the . . . Agency. . . . In recognition of the importance of the International Atomic Energy Agency, the government of the United States of America and the Community will consult with each other from time to time to determine whether there are any areas of responsibility with regard to safeguards and control and matters relating to health and safety in which the Agency might be asked to assist."

The net effect of all this is that, under the proposed agreement with Euratom, Euratom itself will run its own safeguards system, but presumably will establish and run the system in a manner satisfactory to the U.S., at least insofar as U.S. materials are concerned.

Third Party Liability: One of the problems considered by the American atomic industry to be of over-riding importance in regard to the export of U.S. goods and equipment is the problem of third party liability. The proposed Agreement for Cooperation between the U.S. and Euratom touches on this problem in these words:

"The government of the United States of America and the Community recognize that adequate measures to protect equipment manufacturers and other suppliers as well as the participating utilities against now uninsurable risks are necessary to the implementation of the joint program. The Euratom Commission will seek to develop and to secure the adoption, by the earliest practicable date, of suitable measures which will provide adequate financial protection against third party liability. Such measures could involve suitable indemnification guarantees, national legislation, international convention, or a combination of such measures."

In a working paper accompanying the Agreement for Cooperation, the U.S.-Euratom negotiators went on to say: "At this juncture, of course, it is not known what form the legislation in the various countries—or perhaps an interna-

tional convention—may take, the extent to which it will protect suppliers and enterprises against liability, beyond the coverage of insurance they can get, or how long it will take to get the legislation enacted or the convention ratified. For the interim period, until such legislation or convention becomes effective, adequate protection would require an indemnification guarantee from the Community or the nation or nations concerned with the reactor or reactors."

Other Points: Among the other points covered in last month's Euratom package are the following:

- The Agreement for Cooperation says that "the U.S. Commission will assist the Euratom Commission in obtaining reactor materials other than special nuclear material from private organizations located in the U.S. if the Euratom Commission desires such assistance."
- The two parties have agreed to "work closely together to develop training programs to satisfy requirements of the joint program." In this connection, the draft Agreement says that "the parties may under mutually agreeable terms and conditions make available their facilities for use by the other, including facilities to meet training needs."
- The Euratom Commission has agreed to "take all action open to it under the treaty establishing the European Atomic Energy Community to minimize the impact of customs duties on goods and products imported under the joint program."
- The draft Agreement says that "existing Agreements for Cooperation in the field of nuclear energy between member states and the U.S. government are not modified by the joint program," and adds: "Modifications may be made as necessary by mutual agreement between the member states concerned and the U.S. to permit transfers of reactor projects now contemplated under existing agreements that qualify for and are accepted under the joint program."
- The Memorandum of Understanding between the U.S. and Euratom contemplates that the one million kilowatt program "will lead to further cooperation between the Community and the U.S. in other fields related to the peaceful uses of atomic energy."

Summary: The net effect of the Euratom package delivered to the Congress last month, if approved by Congress, would be to establish a program that would function generally as follows:

1. The Euratom Commission, together with the U.S. AEC where pertinent, would establish criteria as to the types, numbers, sizes, location, economics, etc. of reactor projects eligible for loans and fuel guarantees under the one million kilowatt program. Naturally the criteria would state that all reactors included in the program must be of a "proven type" and of U.S. design.

2. Any European utility, whether private or public, wishing to build an atomic power plant of U.S. "proven-type" design with the benefit of long-term, low-interest financing and guaranteed fuel cycle costs for 10 years would apply to the Euratom Commission for approval of its project. (It is understood that there are at least six European utilities ready to make application under the program.)

3. Any proposal submitted by a European utility would presumably include the name of, and would be largely based upon information supplied by, a prime contractor which would be either a U.S. company or a European licensee of a U.S. company. (There is no proviso in the Euratom papers that the selection of a contractor must be by competitive bidding.)

4. All proposals submitted would be reviewed by both the Euratom Commission and the U.S. AEC (from slightly different points of view) and either accepted or rejected. Certainly one of the prime factors taken into account by the two Commissions would be the price of the plant and the commercially guaranteed cost of the fuel.

5. It would appear that the fuel element contractor could either be the prime reactor contractor or somebody else. If he is somebody else, it would seem that he could participate either through a subcontract to the prime reactor contractor or in a direct contractual relationship with the purchasing utility. In this connection, however, there is little doubt that, for purposes of administrative simplicity if for no other reason, the system favors a situation where the fuel element fabricator would either be the prime reactor contractor himself or a subcontractor to the prime contractor.

6. Once a project is approved, the utility involved would reasonably be expected to muster conventional financing equal to the amount required to build a conventional facility of equiva-

lent kilowattage. Beyond this amount, the utility would have access to low-interest, long-term loans from funds available through Euratom from the U.S. Export-Import Bank and also the European Investment Bank and various national governments. Presumably the funds available from these latter two sources would be prorated among the various individual projects on a more or less straight kilowattage basis, although this need not necessarily be the case. The fact is, however, that by one route or another each European utility embarking on an approved Euratom project would have available to it the money that it needs to meet its capital costs.

7. Once a U.S. manufacturer became a party to an approved Euratom project, he would take on an obligation to make all of the non-patentable information developed on the project available to the U.S. and Euratom Commissions. It would seem, however, from information now at hand, that he would take on no obligation to grant any patent rights or access to his records to governmental agencies solely by virtue of his participation in an approved project benefiting from government loans.

8. Any European utility having its atomic power project approved as part of the one million kilowatt Euratom program would be entitled, not only to access to a long-term government loan, but also to a guaranteed maximum fuel cycle cost designed to hold his overall expenses down to an acceptable level. This guarantee would be underwritten by the U.S. government by agreement with Euratom. So far as the European buyer is concerned, the guarantee would appear directly only in his contract with the American supplier, without the U.S. government being a direct party to the contract. The government obligation to underwrite the guarantee would actually be taken care of in a separate contract between the U.S. AEC and the U.S. supplier.

9. Each U.S. fuel supplier would have the option of meeting Euratom's minimum fuel guarantees himself or of looking to the U.S. government to back him up. If he is prepared to meet the guarantees himself, including whatever extra charges may be incurred in regard to chemical processing and transportation by virtue of failure of his fuel elements, then it would seem from the Euratom plan as proposed that he would be insulated from governmental intrusion into his normally private commercial affairs.

10. If a U.S. fuel supplier accepts U.S. government underwriting of his fuel element guarantee, then he must give up his right to commercial privacy. This is because, along with each governmental guarantee will go a governmental right to have access to the records pertaining to the work to which the guarantee applies. So far as the intent of the U.S. negotiators of the agreement with Euratom is concerned, that is the only right that the government will have because of its guarantee activity. Specifically, it is the intent of the U.S. negotiators that the government will not acquire patent rights because of its guarantee activity. Whether this intent can prevail, however, without a specific waiver by the AEC of its possible statutory rights to patents, is of course not yet known.

11. The uranium for the initial fuel elements in the one million kilowatt program would be provided by the U.S. and would be bought by Euratom under a deferred payment plan that, in effect, would end up with Euratom paying 4% for the use of the elements plus the regular U.S. price for whatever U-235 was actually burned up or otherwise not returned for resale to the U.S. Although Euratom would retain title to the uranium, the cost of the burned up fuel plus the 4% presumably would be passed on to the using utilities. The uranium in fuel reloadings would be bought and paid for outright by Euratom.

12. After irradiation, fuel elements—until chemical processing facilities are available in Europe—would be returned to the U.S. for processing. This contract would be direct with the U.S. AEC, which operates the only chemical processing facilities in the U.S. The AEC would charge its regular prices for this service, plus the cost of transporting the irradiated elements and less the value of U-235 and plutonium extracted from the fuel and kept by the U.S. (Calculations made to date are on the basis of a $12 per gram value for the plutonium.)

13. In case of the premature failure of elements covered by a U.S. government guarantee, the U.S. AEC would attempt to cover its obligations under the guarantee by reducing its chemical processing and transportation charges. It would also be prepared to make a direct contribution to fabrication costs of new elements where necessary. There would be no obligation on anybody's part to buy new elements or reloadings from the initial core supplier.

14. The guarantee and buy-back portions of the program would last for 10 years after the start-up of a plant or until the end of 1973, whichever is earlier.

15. The power plant program would be accompanied by a 10-year research and development program to which the U.S. and Euratom would each contribute $50 million during the first five years. It would be expected that much of the work under the R&D program would be done by contractors participating in the power plant program.

Congressional Reaction: The immediate reaction of the Democratic Congressional majority to last month's package for Euratom can probably best be summed up in the following consensus paraphrase:

"This is a formidable package and it has been given to us very late in this session. We are not unsympathetic to the objectives of the proposed program or to the idea of cooperation with Euratom. We will, however, want to assure ourselves as to the safeguards and inspection features of the program and as to whether the U.S. government's interests are fully protected in regard to the subsidy features of the fuel cycle guarantee. We are also wondering if it is really desirable to start all six of the proposed projects in 1959. Perhaps, if the program were phased out a little, some more types besides the present 'proven types' could be included.

"There are probably several good ways to help Euratom. This may be one of them, although at first glance it would seem to be unnecessarily complicated. We might wish to explore alternative, possibly simpler or better approaches before we authorize this program to go forward as presented. There is very little time left to do all this in this session."

Considering this reaction, it would probably not be surprising if the generalities of the program win Congressional approval in this session of Congress, with the details put over until next year. This might delay some aspects of the program, but it would at least assure both Euratom and the U.S. government and industry that some kind of a U.S.-Euratom program of comparable magnitude would go forward.

If the Congress wishes to approve the generalities but not the details of the proposed program, it could do so by approving the International Agreement. It could probably also approve the Agreement for Cooperation without committing the U.S. to the details of the proposed program, inasmuch as the provisions of the Cooperation Agreement involving federal funds cannot take effect until and unless specific additional authorizing legislation is passed. Examples of such provisions are those having to do with fuel guarantees, plutonium buy-back and the research program. Actually, of these three, the one with the best chance of being authorized this session is the research program, and the one with the least chance is the fuel guarantee.

Industrial Reaction: The industrial reaction to the Euratom package is that the package contains a lot of unanswered questions about how the system will operate. In particular, industrial representatives are concerned about the extent that governments may be permitted under the system to intrude into their normally private commercial affairs. In this connection, industrial representatives have expressed concern over the rights of Euratom and the U.S. government to non-patentable information developed on projects in the program. As a result of this concern, the U.S. AEC has indicated it may, by an exchange of correspondence with Euratom, document the intent of both parties to "foster normal industry-to-industry relationships" by means of the Euratom program.

The U.S. industry has also expressed concern as to the amount of the program's total equipment and component business that will flow to U.S. manufacturers, and has raised a myriad of questions—to some of which there are as yet no answers—as to the details of the fuel guarantee mechanism.

To obtain the detailed reaction of industry, the Joint Committee has circulated a list of questions about the Euratom program to industrial concerns, and the AEC held a meeting for about 60 industrial representatives on Tuesday, July 8.

The Next Step: The next step for the Euratom package will be hearings before the Joint Committee which are scheduled to start on Wednesday, July 16. AEC and State Department witnesses are expected to testify on the need for

Congressional approval of the Euratom proposals this year. Industrial witnesses are also expected to be welcome to testify on their reactions to the Euratom package.

Proponents of the proposed program feel that the proposals they have made are the best possible under the circumstances. In essence, their position is this:

"We had to find a program that would interest the European utilities and yet not be a windfall either for them or for the American manufacturer. We think we have done that. The European utilities will be paying from one and a half to two mills more for their atomic power than they will be for conventional power, but they will be preparing themselves for the future and will, at the same time, have the hope that within 10 years or so their atomic power costs, even from these first plants, may be less than from conventional facilities.

"As to the fuel guarantee, we had to offer that because the European buyer feels he must have a ceiling on his potential fuel costs and, as long as the U.S. manufacturer is unwilling to guarantee his fuel product to the extent necessary, we feel that the government has to do it. Although we didn't set out to match them, our guarantee actually is essentially the same, so far as total cost is concerned, as that which is already available on the world market from the British government.

"All in all, we feel that we have come up with the best arrangement that can be developed right now, and we think that critics of the plan should be prepared to offer, along with their criticism, something they consider will work better."

NEWS ABOUT INDUSTRY

West German Utility Buys 15,000 Kilowatt GE Reactor

The West German electric utility company Rheinisch-Westfälisches Elektrizitätswerk signed a contract last month with Allgemeine Elektrizitäts-Gesellschaft for the purchase of a 15,000 ekw boiling water reactor power plant at a cost of $10 million. The reactor is to be purchased from the U.S.'s General Electric Co., while AEG will supply conventional turboelectric equipment. The German firm of Hochtief A.G. will be the architect-engineer. Construction of the plant is scheduled to begin immediately, with completion scheduled by the end of 1960. The site is at Kahl, near Frankfurt.

The AEG-GE proposal was selected from among four submitted to RWE (see *Memo* for June, p. 23). The other bidders were ACF Industries, Inc. for a 16,000 ekw boiling water reactor; Westinghouse Electric Corp. and Siemens-Schuckertwerke A.G. for an 11,400 ekw pressurized water reactor; and Mitchell Engineering Co. Ltd. (which is associated with American Machine & Foundry Co.) in cooperation with General Nuclear Engineering Corp. and Brown, Boveri for a 16,000 ekw boiling water reactor.

RWE is also planning to purchase a large-scale British gas cooled reactor of the improved Calder Hall type. It is reported, however, that negotiations for the British reactor are temporarily stalled pending the working out of arrangements covering the supply of nuclear power equipment between Britain and Euratom, of which West Germany is a member.

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GENEVA COMMERCIAL EXHIBITION: A full-scale model of the core of an atomic power plant capable of producing 150,000 kilowatts of electric power will be the focal point and symbol of the U.S. section of the commercial exhibition to be held next September in Geneva, Switzerland, in conjunction with the second UN International Conference on the Peaceful Uses of Atomic Energy. Surrounding the model core will be a rotunda containing an information center and displays through which the overall story of the U.S. atomic industry will be told. On either side of the rotunda will be the commercial exhibits